WOODS HOLE OCEANOGRAPHIC INSTITUTION

Reference No. 60-27

Preliminary Report CHAIN #11
22 February - 22 March 1960

WOODS HOLE, MASSACHUSETTS

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

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Preliminary Report CHAIN #11
22 February - 22 March 1960

by

Earl Hays

July 1960

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APPROVED FOR DISTRIBUTION _____
Paul M. Fye, Director

ABSTRACT

The second half of CHAIN Cruise #11, 22 February until 22 March, 1960, is detailed as to type of measurements made with their specific locations. The cruise areas were in the St. Croix region, the Puerto Rico Trench and the tracks from the Bahamas to Bermuda to Woods Hole. Camera lowerings, lowerings of the thermal probe and accompanying cores, dredging, sound velocimeter lowerings, and acoustic studies of the scattering layer were the special events undertaken while precision bathymetry and towing of the Continuous Temperature Recording Chain were on a watch standing basis.

Part two of CHAIN Cruise #11 had three special objectives with a continuing background of other activities. One of the special objectives was to obtain topographic information around St. Croix to correlate with a land survey. John Whetten, a graduate student at Princeton, is making a geological study of St. Croix for his doctoral thesis. A fault runs Northeast to Southwest across St. Croix and we hoped to trace the fault off shore using the WHOI sparker. The region where the fault apparently enters the water, however, has very steep relief, and there is little hope of obtaining much information from the records taken. However, we made bathymetric surveys at both ends of the fault region and made three camera lowerings down the slopes. In addition, we did some bathymetry to add to that of Frassetto and Northrup (1957) in the area, and took a core in the St. Croix Basin for Whetten to study. Dredge hauls were also made on the slopes, but no rock was obtained.

Harold Edgerton of MIT was aboard with his usual enthusiasm for deep sea photography. His special interest was in obtaining pictures in the Puerto Rico Trench. This we succeeded in doing. Figures 1 and 2 are pictures taken at 3800 and 4200 fathoms respectively, at longitude 66°30 on the northern side of the trench. We made dredge hauls in this area, but only brought up mud. During Edgerton's 10-day stay, in addition to the Puerto Rico Trench lowerings and the St. Croix lowerings we made a lowering across the sill in the Anegada passage into the Virgin Island Basin and two lowerings into scattering layers with a camera Edgerton put together on the cruise. This camera was towed behind the ship at speeds up to 5 knots. The film has been looked at, but no animals were seen. In addition to the above camera lowerings, others were made on the Outer Ridge (21°N, 66°30'W), on the south eastern slope of Bermuda, and on the Bahamas Bank.

The third special objective was to co-operate with John Reitzel in making measurements of the thermal gradient in the deep basins. This is done by driving a long probe containing temperature sensitive devices into the sediments and letting it come to thermal equilibrium before hauling on it. A buoy was set so that the ship could maintain its position over the probe, and the slack wire paid out could be a minimum. In addition, a core is taken in which thermal conductivity is measured; the combined measurements, gradient, and conductivity, thus result in a heat flow measurement. Five buoys were set and five lowerings (one a test lowering) were made. Small water leaks nullified the first three thermal probe lowerings but the final lowering was successful. Immediate analysis of

the data have indicated a heat flow slightly less than the value of 1.2 micro-calories per square centimeter per second, which is the currently accepted value.

The morning and evening vertical migrations of the scattering layers were recorded acoustically using explosives as sound sources, detecting the returns with the QBG hydrophone and recording on magnetic tape. Several layers were recorded whose central frequency responses were above 16 kc/sec. Also, a quite deep layer-like return (600-700 fathoms) was seen in the low frequency but this must await further analysis before it can be identified as a scattering layer.

The NBS sound velocimeter was lowered during the program as other work permitted. We had hoped to make a lowering to the bottom of the Puerto Rico Trench but a winch failure deprived us of our long wire.

The thermistor chain was towed during practically all steaming time. In addition, a 24-hour station was made in the Caribbean and several tracks were traversed several times. The run from Eleuthera to Bermuda and return was a continuation of our studies of the near surface temperature conditions along this track.

The Precision Graphic Recorder was used continually for echo-sounding, with emphasis on fast sweep speeds and short pulses to obtain bottom penetration data. This was particularly successful in the region near 27.5°N and 72.5°W. Here we were able to continue a study commenced in February 1959 during CHAIN Cruise #5. As many as five possible layers are seen on the records, with the layers having essential continuity over distances of miles. (A record from the same general region was published by Heezen (1959). One of the interesting features of this is that the bottom is not flat but has relief of the order of tens of fathoms occurring in lateral distances of miles. There is a tendency for the layers to be thicker at the top of the rises than in the low places. This could imply geological activity since the deposition of the sediments. Our present information is limited to PGR reconnaissance and superficial bottom sampling; more detailed charting is necessary and very long cores will be needed to identify even the shallowest layers. Seismographic measurements of sound velocity will be generally valuable.

Evidence of some rather strong currents was obtained near 31°50'N, 72°30'W during the heat probe lowering. A buoy was set out on 3/8"

polypropylene in 2830 fathoms with a tag line about one-half mile long that had another buoy attached. (Two styrofoam floats 18"x18"x8" were the flotation units for both buoys.) The first buoy towed under about three hours after the plant, and the second buoy disappeared about two hours later. This same set-up had been used near 20°58'N, 66°30'W and 29°10N, 70°W in approximately the same depth of water, wind and sea state without any evidence of towing under.

The camera lowering at 20°54'N, 66°26'W was not very successful in the number of pictures obtained as the lens openings became covered with mud. But three pictures taken before this occurred show the bottom to be covered with cobble size objects, which could be manganese nodules, algal balls, cobbles, or other such objects. Unfortunately, the mud on the cameras prevented us from determining anything about the extent of this type of bottom.

The track of CHAIN is shown in Figures 3, 4 and 5. A summary of the activities is given below.

Scientific Personnel on the Cruise (Part Two) were as follows:

WHOI Personnel

E. Hays, Chief Scientist
A. Carter
L. C. Davis
H. Johnson
A. Nalwalk
R. M. Pratt
J. Reitzel
R. Snyder

MIT Professor

Dr. H. Edgerton (St. Thomas to St. Thomas only)

MIT Graduate Students

G. Beardsley
G. Erlanger
E. Getchell
L. Jacobson
G. Schroeder

Princeton Graduate Student

J. Whetten (St. Thomas to St. Thomas only)

LIST OF REFERENCES

1. Frassetto, Roberto and John Northrup, "Virgin Islands Bathymetric Survey", Deep-Sea Research, Vol. 4, No. 2, pp. 138-146. April 1957.

2. Heezen, B. C., Marie Tharp, and Maurice Ewing, "The floors of the Ocean - I. The North Atlantic", Geol. Soc. Am. Special Paper 65, plate 6, April 1959.

LIST OF FIGURES

Figure 1. Bottom photo taken at 3800 fms. on the northern side of the Puerto Rico Trench.

Figure 2. Bottom photo taken at 4200 fms. on the northern side of the Puerto Rico Trench.

Figure 3. Track of R/V CHAIN, Cruise #11.

Figure 4. Large scale track of R/V CHAIN, Cruise #11, 22-26 February 1960.

Figure 5. Large scale track of R/V CHAIN, Cruise #11, 26 February - 7 March, 1960

Camera Lowerings

No.	Date	Location	Depth	Remarks
1	22 Feb.	17°41'N, 64°55'W	300 fms.	St. Croix
2	23 Feb.	17°50'N, 64°44'W	550 fms.	St. Croix
3	25 Feb.	18°10'N, 64°32'W	550 fms.	Anegada Passage
4	25-26 Feb.	17°41'N, 64°54'W	shallow slope	St. Croix
5	27-28 Feb.	19°32'N, 66°27'W	100-200 fms.	Scattering layer
6	28 Feb.	19°35'N, 66°28'W	4000 fms.	Puerto Rico Trench
7	28-29 Feb.	20°07'N, 66°30'W	3300 fms.	lost camera
8	1 March	19°54'N, 66°33'W	3800 fms.	Puerto Rico Trench
9	2 March	18°45'N, 65°29'W	100-200 fms.	Scattering layer
10	6 March	20°54'N, 66°26'W	2800 fms.	Moho Area
11	10 March	Bahamas Bank	200 fms.	Bahamas
12	10 March	Bahamas Bank	200 fms.	Bahamas
13	10 March	Bahamas Bank	200 fms.	Bahamas
14	14 March	32°15'N, 64°45'W	300 fms.	Bermuda
15	17 March	Bahamas Bank	200 fms.	Bahamas
16	17 March	Bahamas Bank	200 fms.	Bahamas

Cores

No.	Date	Location	Depth	Remarks
4	24 Feb.	18°05'N, 64°15'W	1550 fms.	failed to trigger
5	24 Feb.	18°07'N, 64°20'W	1550 fms.	for heat probe
6	25 Feb.	17°18'N, 65°15'W	2400 fms.	pinger lost on first lowering successful on second
7	29 Feb.	20°53'N, 66°27'W	2850 fms.	for heat probe
8	19 March	31°54'N, 72°27'W	2830 fms.	for heat probe

NBS Velocimeter

No.	Date	Location	Depth	Remarks
1	23 Feb.	17°52'N, 64°21'W	400 fms.	shallow test runs
2	24 Feb.	18°07'N, 64°16'W	1847	
3	26 Feb.	17°20'N, 65°18'W	2376	
4	28 Feb.	19°46'N, 66°39'W	4352 fms.	4366 meters out
5	10 March	Bahamas Bank	600 fms.	
6	10 March	Bahamas Bank	960 fms.	
7	15 March	29°12'N, 70°07'W	2873 fms. to 1400 fms. above bottom	
8	17 March	Bahamas Bank	1070 fms.	
9	17 March	Bahamas Bank	1750 fms.	
10	20 March	33°20'N, 72°17'W	2770 fms. to 1600 fms. above bottom	
11	21 March	37°15'N, 71°35'W	2060 fms.	2200 meters out

Dredge Hauls

No.	Date	Location	Depth	Remarks
*38 Pipe	22 Feb.	17°42'N, 64°55'W	255-428 fms	good
*39 Pipe	7 March	19°59'N, 66°39'W	3315 fms.	good
*5 chain	25 Feb.	17°51'N, 64°52'W	1665-2100 f.	empty
*6 chain	5-6 March	19°54'N, 66°29'W	4200 fms.	empty

*The chain bag dredges both came up empty.

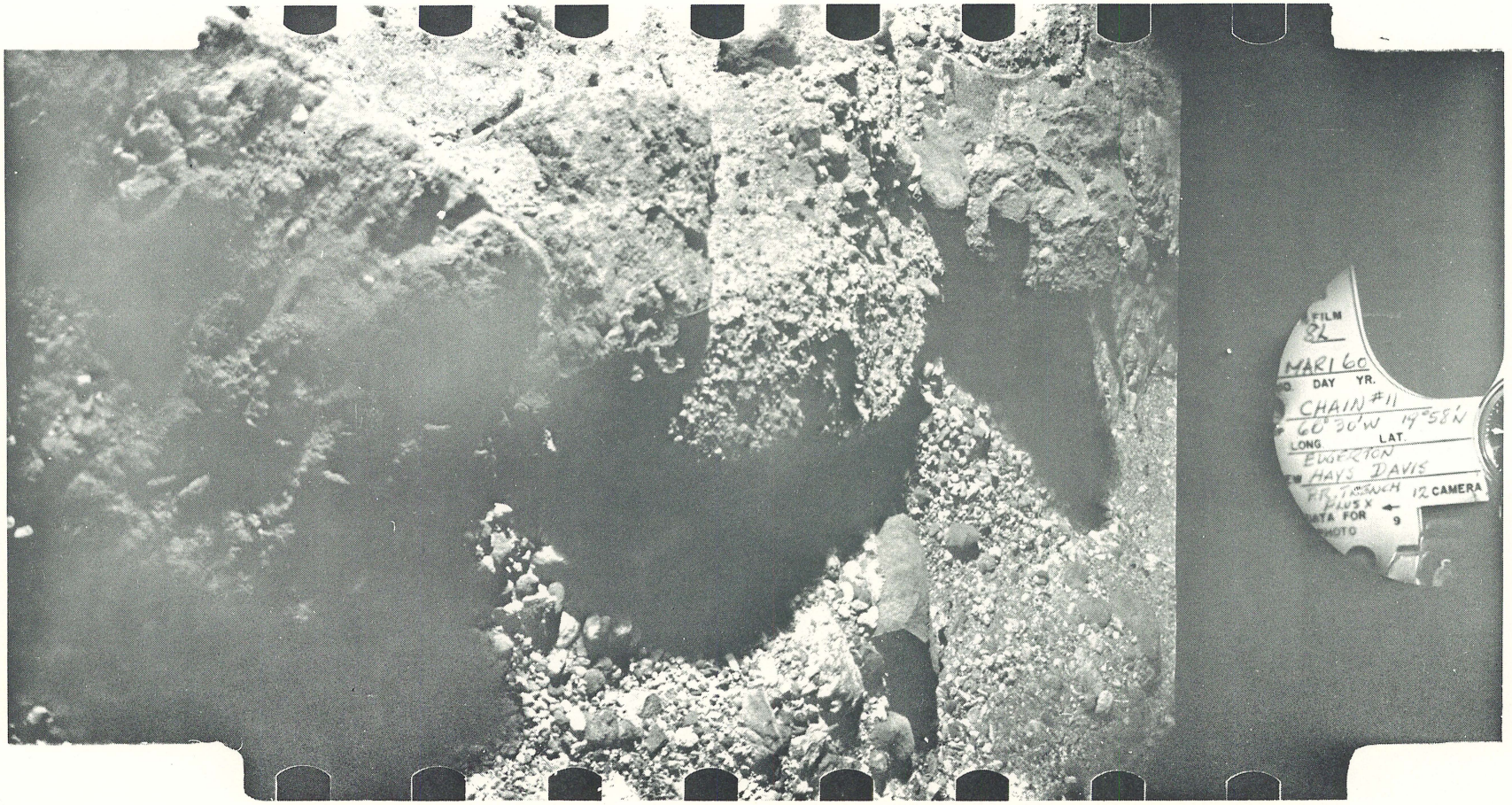
*Both pipe dredges were successful.

Scattering Layer Studies

No.	Date	Location	Remarks
1	23 Feb.	17°50'N, 64°45'W	test
2	27 Feb.	19°35'N, 66°29'W	
3	28 Feb.	19°45'N, 66°38'W	
4	1 March	20°53'N, 66°31'W	
5	1 March		Noise test of Generator
6	8 March	23°08'N, 71°24'W	
7	9 March	23°56'N, 73°27'W	
8	9 March	24°21'N, 75°09'W	
9	15 March	29°12'N, 70°10'W	
10	20 March	33°18'N, 72°21'W	
11	21 March	37°50'N, 71°50'W	

Heat Probe

No.	Date	Location	Remarks
1	24 Feb.	18°05'N, 64°15'W	test
2	26 Feb.	17°20'N, 65°16'W	water leak
3	29 Feb. -1 March	20°53'N, 66°27'W	water leak
4	12 March	29°22'N, 69°57'W	water leak
5	19 March	31°54'N, 72°33'W	successful



BOTTOM PHOTO TAKEN AT 3800 FMS. ON THE NORTHERN SIDE OF THE PUERTO RICO TRENCH

FIG. 1

FIG. 1

BOTTOM PHOTO TAKEN AT 4200 FMS. ON THE NORTHERN SIDE OF THE PUERTO RICO TRENCH

FIG. 2

FIG. 2

FIG. 3

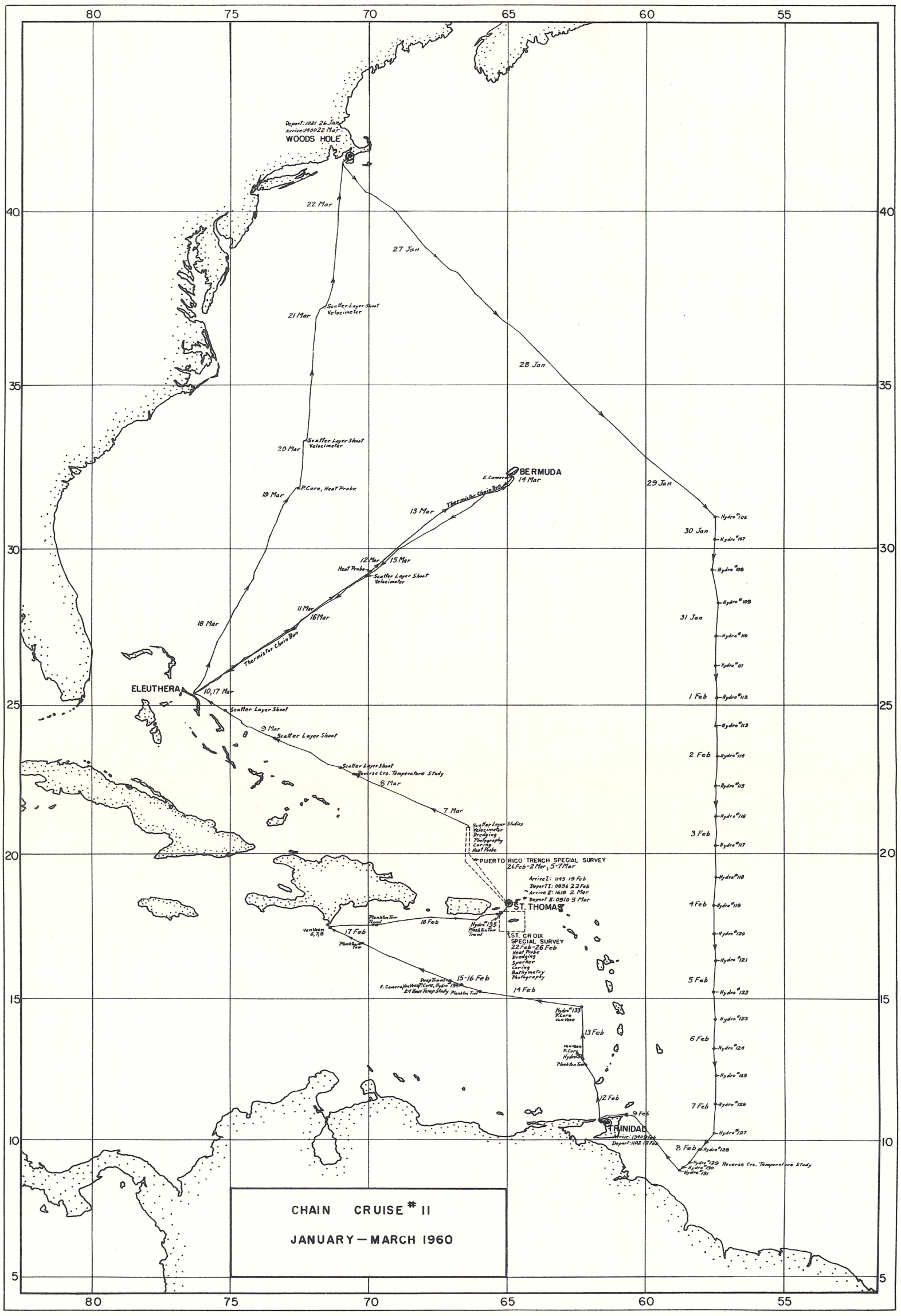

80
75
70
65
60
55
40
35
30
25
20
15
10
5
Depart: 1021 26 Jan
Arrive: 1900 22 Mar
WOODS HOLE
22 Mar
27 Jan
21 Mar
Scatter Layer Shoot
Velocimeter
28 Jan
20 Mar
Scatter Layer Shoot
Velocimeter
BERMUDA
E. Camera
14 Mar
29 Jan
19 Mar
P. Core, Heat Probe
13 Mar
Thermistor Chain Run
30 Jan
12 Mar
15 Mar
Heat Probe
Scatter Layer Shoot
Velocimeter
11 Mar
16 Mar
18 Mar
31 Jan
Thermistor Chain Run
ELEUTHERA
10, 17 Mar
1 Feb
Scatter Layer Shoot
9 Mar
Scatter Layer Shoot
Scatter Layer Shoot
Reverse Crs. Temperature Study
2 Feb
8 Mar
7 Mar
Scatter Layer Studies
Velocimeter
Coring
Dredging
Photography
Heat Probe
PUERTO RICO TRENCH SPECIAL SURVEY
24 Feb-2 Mar; 5-7 Mar
Arrive I: 1145 19 Feb
Depart I: 0836 22 Feb
Arrive II: 1618 2 Mar
Depart II: 0910 5 Mar
ST. THOMAS
3 Feb
4 Feb
Plankton Tow
Trawl
18 Feb
Hydro # 133
Plankton Tow
Trawl
Van Veen
6, 7, 8
17 Feb
Plankton Tow
ST. CROIX
SPECIAL SURVEY
22 Feb-26 Feb
Heat Probe
Dredging
Sparker
Coring
Bathymetry
Photography
5 Feb
15-16 Feb
E. Camera
Van Veen
P. Core, Hydro 135
24 Hour Temp Study
Deep Trawl
Plankton Tow
14 Feb
Hydro # 133
P. Core
Van Veen
13 Feb
Van Veen
P. Core
Hydro 134
Plankton Tow
6 Feb
12 Feb
9 Feb
7 Feb
TRINIDAD
Arrive: 1340 7 Feb
Depart: 1102 12 Feb
8 Feb
Hydro # 105
Hydro # 106
Hydro # 107
Hydro # 108
Hydro # 109
Hydro # 110
Hydro # 111
Hydro # 112
Hydro # 113
Hydro # 114
Hydro # 115
Hydro # 116
Hydro # 117
Hydro # 118
Hydro # 119
Hydro # 120
Hydro # 121
Hydro # 122
Hydro # 123
Hydro # 124
Hydro # 125
Hydro # 126
Hydro # 127
Hydro # 128
Hydro # 129 Reverse Crs. Temperature Study
Hydro # 130
Hydro # 131
CHAIN CRUISE # 11
JANUARY — MARCH 1960

FIG. 3

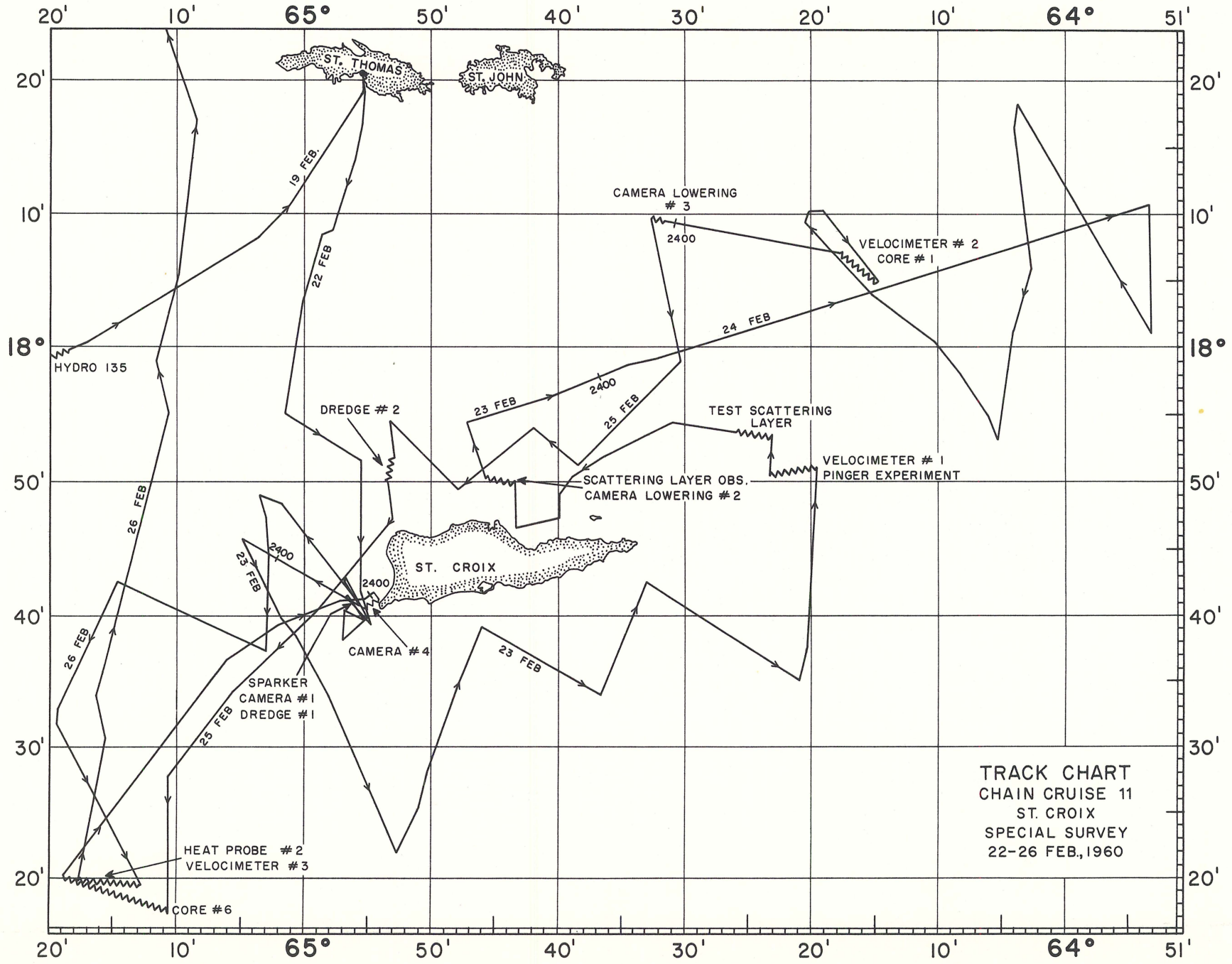

20' 10' 65° 50' 40' 30' 20' 10' 64° 51'
20'
10'
18°
50'
40'
30'
20'
ST. THOMAS
ST. JOHN
19 FEB.
22 FEB
CAMERA LOWERING # 3
2400
VELOCIMETER # 2 CORE # 1
24 FEB
HYDRO 135
DREDGE # 2
23 FEB
2400
25 FEB
TEST SCATTERING LAYER
VELOCIMETER # 1 PINGER EXPERIMENT
SCATTERING LAYER OBS. CAMERA LOWERING # 2
26 FEB
2400
23 FEB
2400
ST. CROIX
CAMERA # 4
26 FEB
23 FEB
SPARKER CAMERA # 1 DREDGE # 1
25 FEB
HEAT PROBE # 2 VELOCIMETER # 3
CORE # 6
TRACK CHART
CHAIN CRUISE 11
ST. CROIX
SPECIAL SURVEY
22-26 FEB., 1960

FIG. 4

FIG. 4

FIG. 5

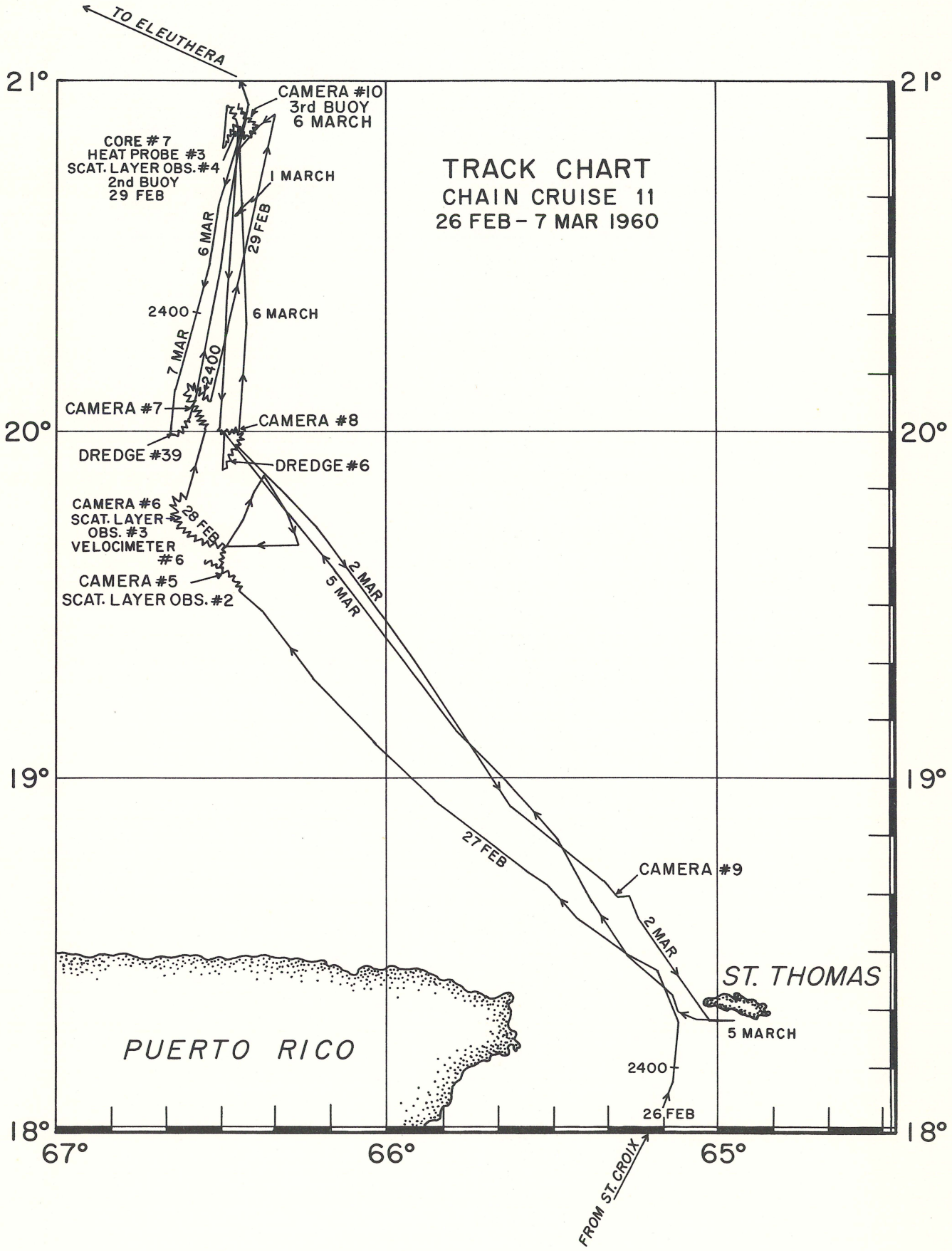

TO ELEUTHERA
TRACK CHART
CHAIN CRUISE 11
26 FEB - 7 MAR 1960
21°
20°
19°
18°
67°
66°
65°
CAMERA #10
3rd BUOY
6 MARCH
CORE # 7
HEAT PROBE #3
SCAT. LAYER OBS. #4
2nd BUOY
29 FEB
1 MARCH
6 MAR
29 FEB
2400
6 MARCH
7 MAR
2400
CAMERA #7
CAMERA #8
DREDGE #39
DREDGE #6
CAMERA #6
SCAT. LAYER
OBS. #3
VELOCIMETER
#6
28 FEB
2 MAR
5 MAR
CAMERA #5
SCAT. LAYER OBS. #2
27 FEB
CAMERA #9
2 MAR
ST. THOMAS
5 MARCH
PUERTO RICO
2400
26 FEB
FROM ST. CROIX

FIG. 5

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